

### **Abstract of the Disclosure**

5            Microparticles 8 includes an optical substrate 10 having at least one diffraction grating 12 disposed therein. The grating 12 having a plurality of colocated pitches A which represent a unique identification digital code that is detected when illuminated by incident light 24. The incident light 24 may be directed transversely from the side of the substrate 10 with a narrow band (single wavelength) or multiple wavelength source, in which case the code is represented by a spatial distribution of light or a wavelength spectrum, respectively. The code may be digital binary or may be other  
10           numerical bases. The micro-particles 8 can provide a large number of unique codes, e.g., greater than 67 million codes, and can withstand harsh environments. The micro-particles 8 are functionalized by coating them with a material/substance of interest, which are then used to perform multiplexed experiments involving chemical processes, e.g., DNA testing and combinatorial chemistry.